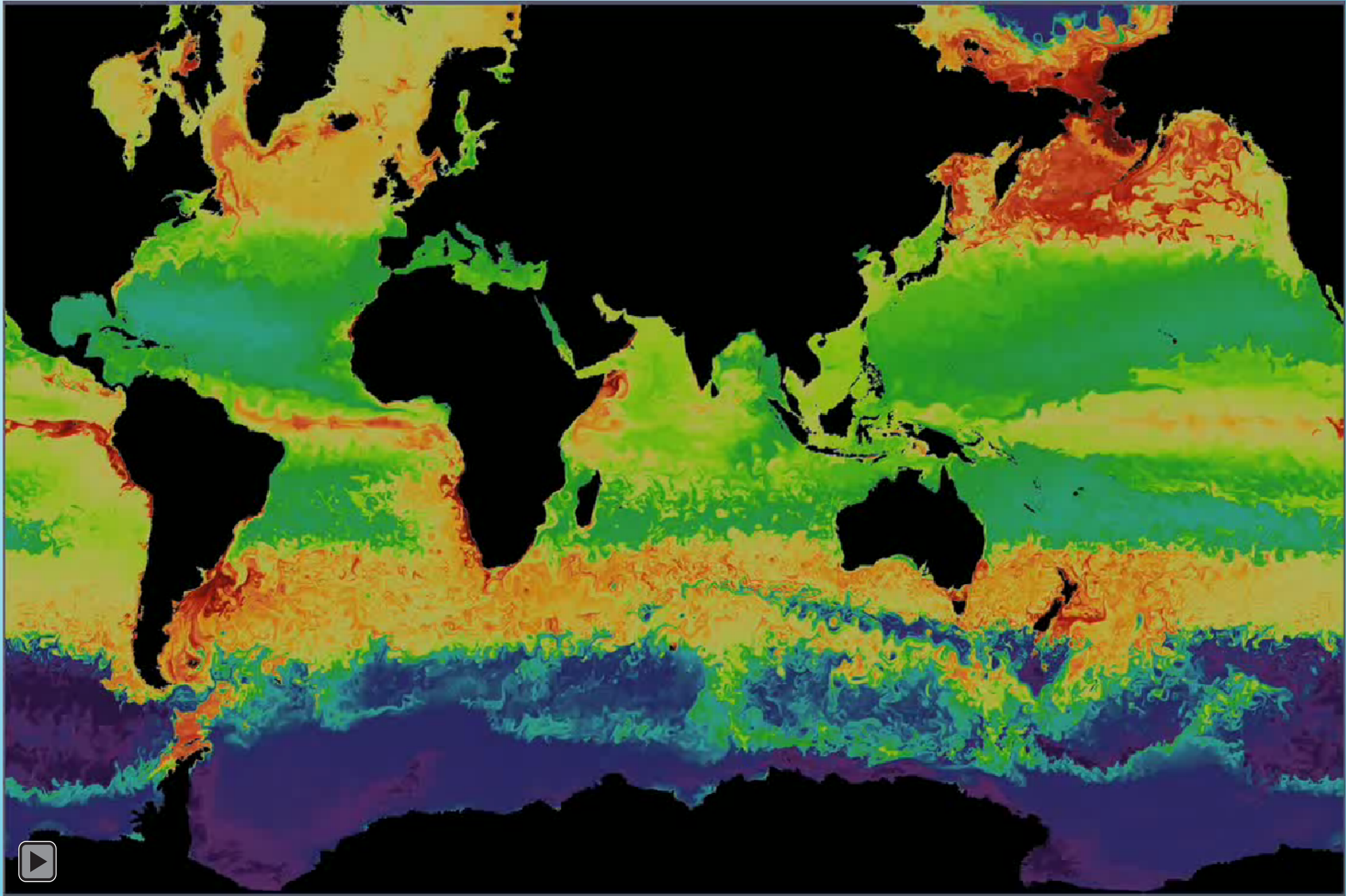


CLIMATE, OCEAN AND SEA ICE MODELING

PARALLEL OCEAN PROGRAM (POP)

Climate Simulation

Biogeochemistry



Chlorophyll concentration from an eddy-resolving POP simulation with full ocean biogeochemistry

The LANL POP model includes a biogeochemical component to simulate ocean ecosystems and the exchange of CO₂ and other compounds at the air/sea interface. The model is used to explore ocean acidification, sea floor methane release and the future ability of the ocean to sequester further CO₂ emissions.

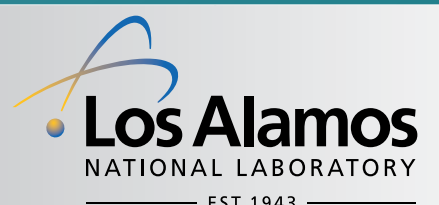


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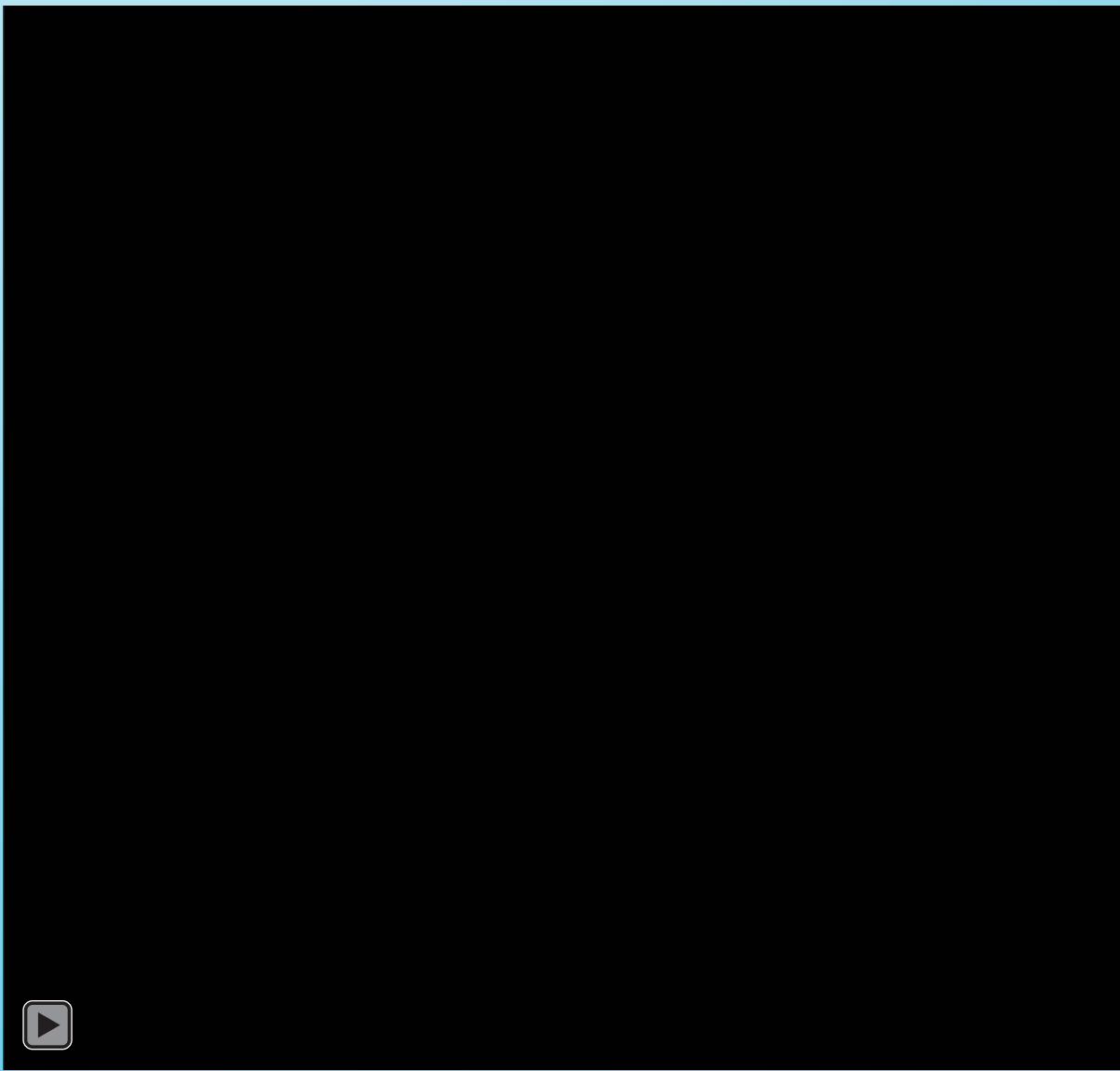
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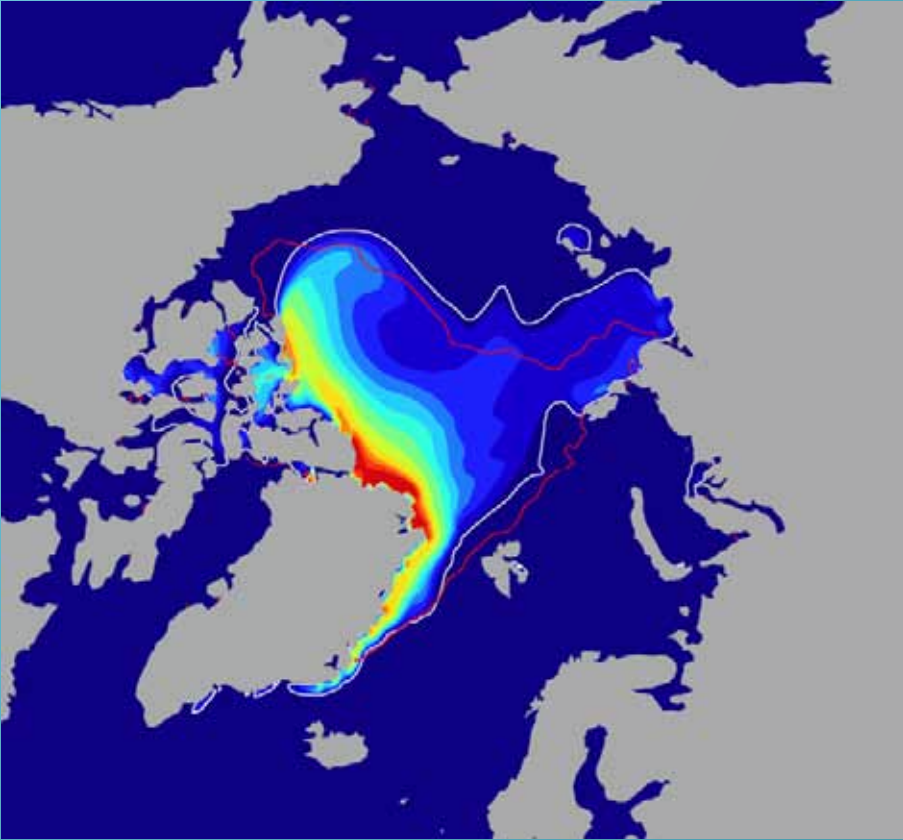


CICE: The Los Alamos Sea Ice Model

Arctic sea ice is rapidly retreating.



Ice thickness (m) simulated by the CICE model from 1975 to 2007



Final 2007 ice concentration with red line indicating satellite measurement of ice extent.

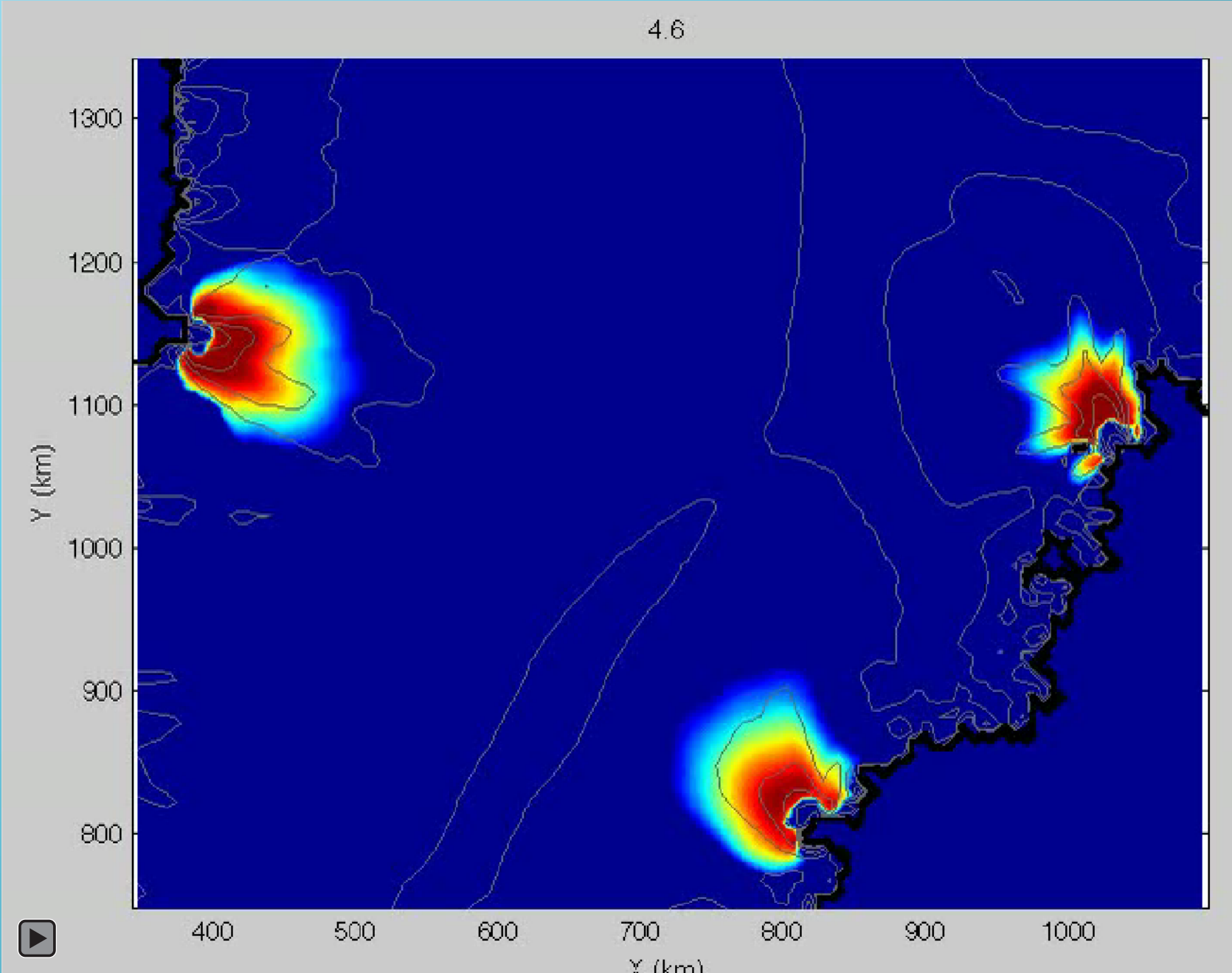
Advanced sea ice models like CICE are required to predict when the Arctic will be ice-free and what processes are responsible for the rapid retreat.



CISM: The Community Ice Sheet Model Ice Sheets and Sea Level Rise

Melting of large ice sheets like Greenland and W. Antarctica can result in significant sea level rise: 6 meters for each.

Simulation of ice sheet acceleration following breakup of ice shelves at glacier outlets.



Dynamic ice sheet models like CISM are needed to understand whether dynamical processes will accelerate sea level rise over the next 100 years.

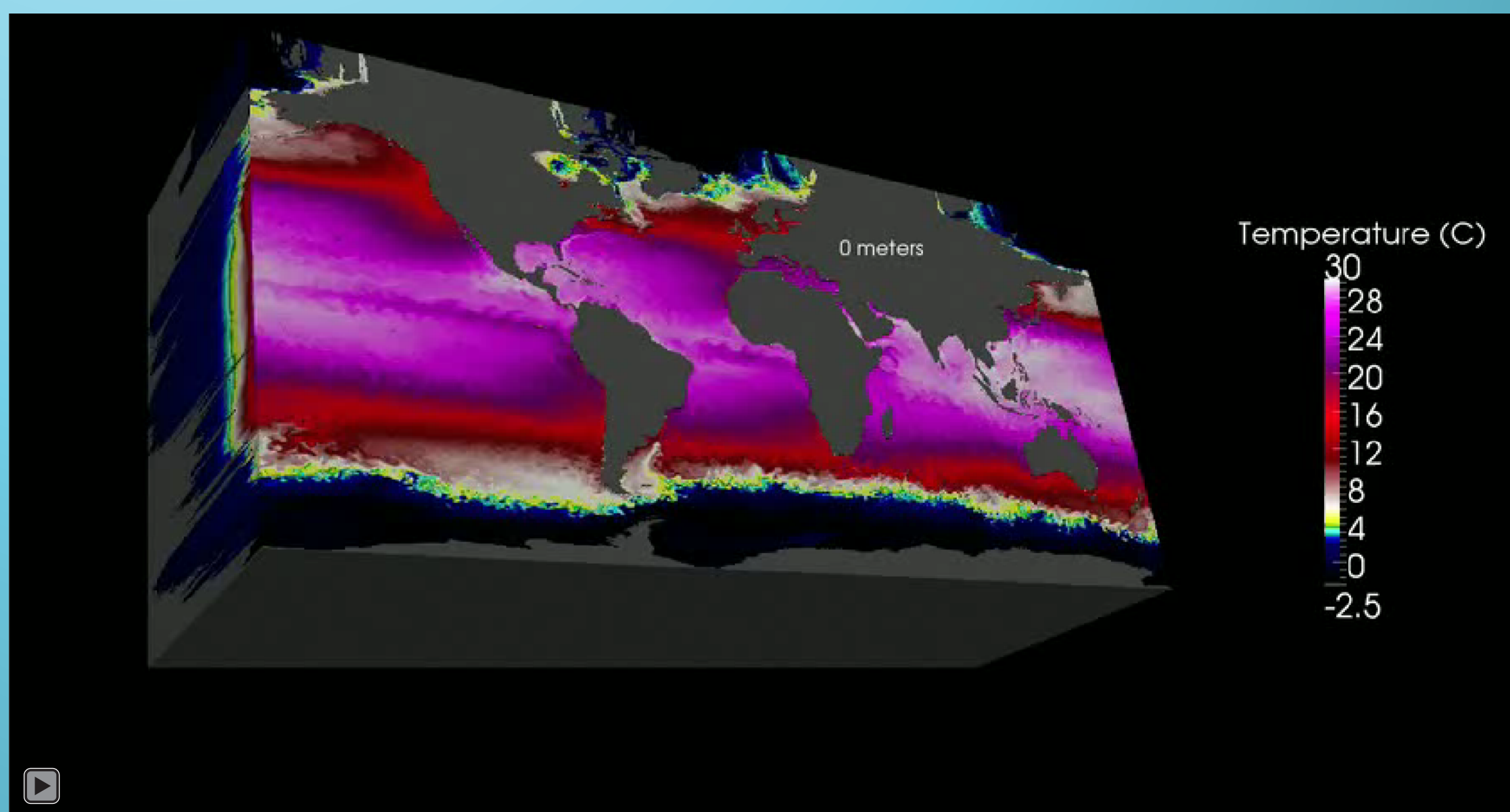


CLIMATE, OCEAN AND SEA ICE MODELING

Climate Simulation

The Climate, Ocean and Sea Ice Modeling (COSIM) project

COSIM develops high-performance models of ocean, sea ice, and land ice for studying high-latitude climate change and its impacts throughout the globe.



Our models include:

- The Parallel Ocean Program (POP)
- The CICE sea ice model (CICE)
- The Glimmer-Community Ice Sheet Model (Glimmer-CISM)

<http://climate.lanl.gov>



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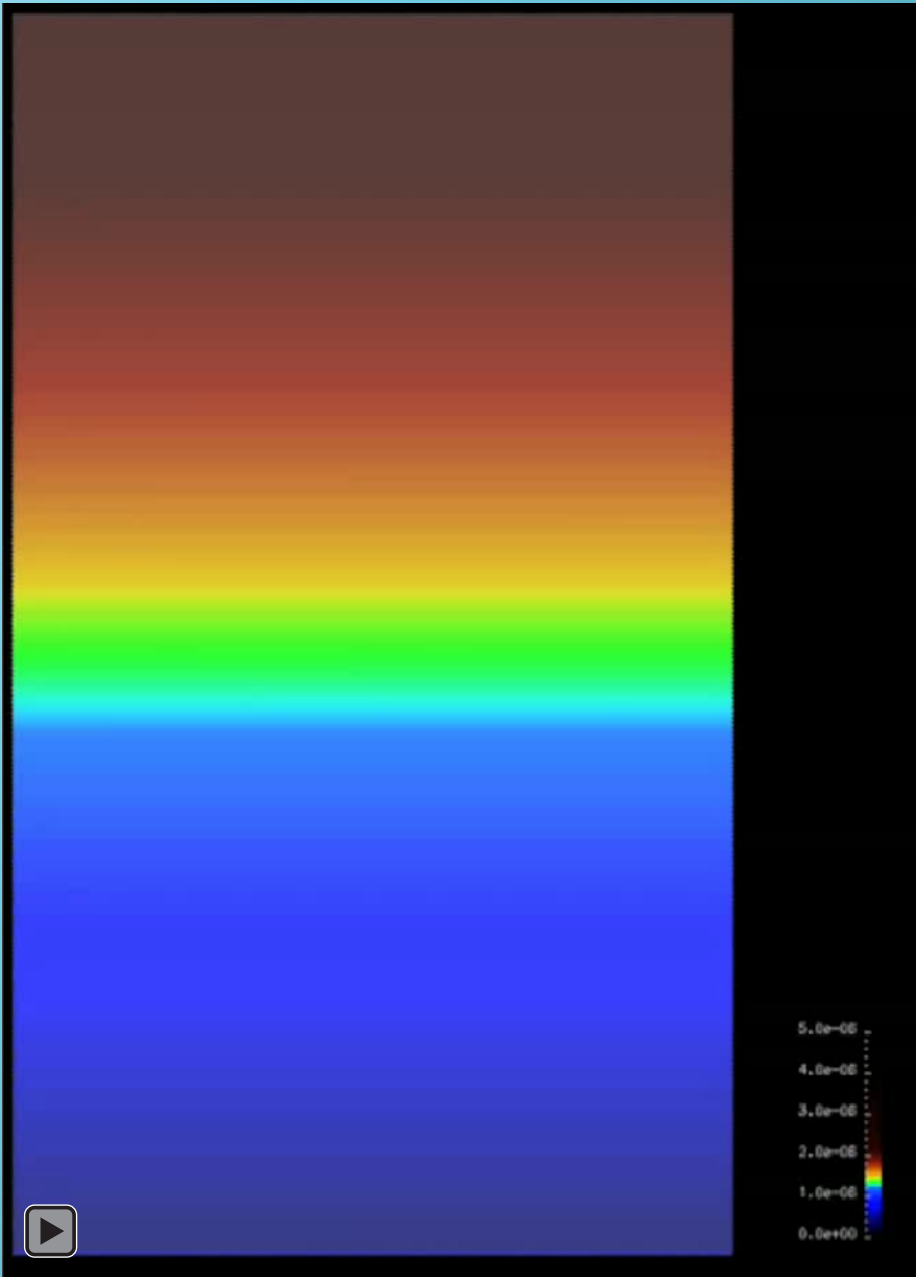
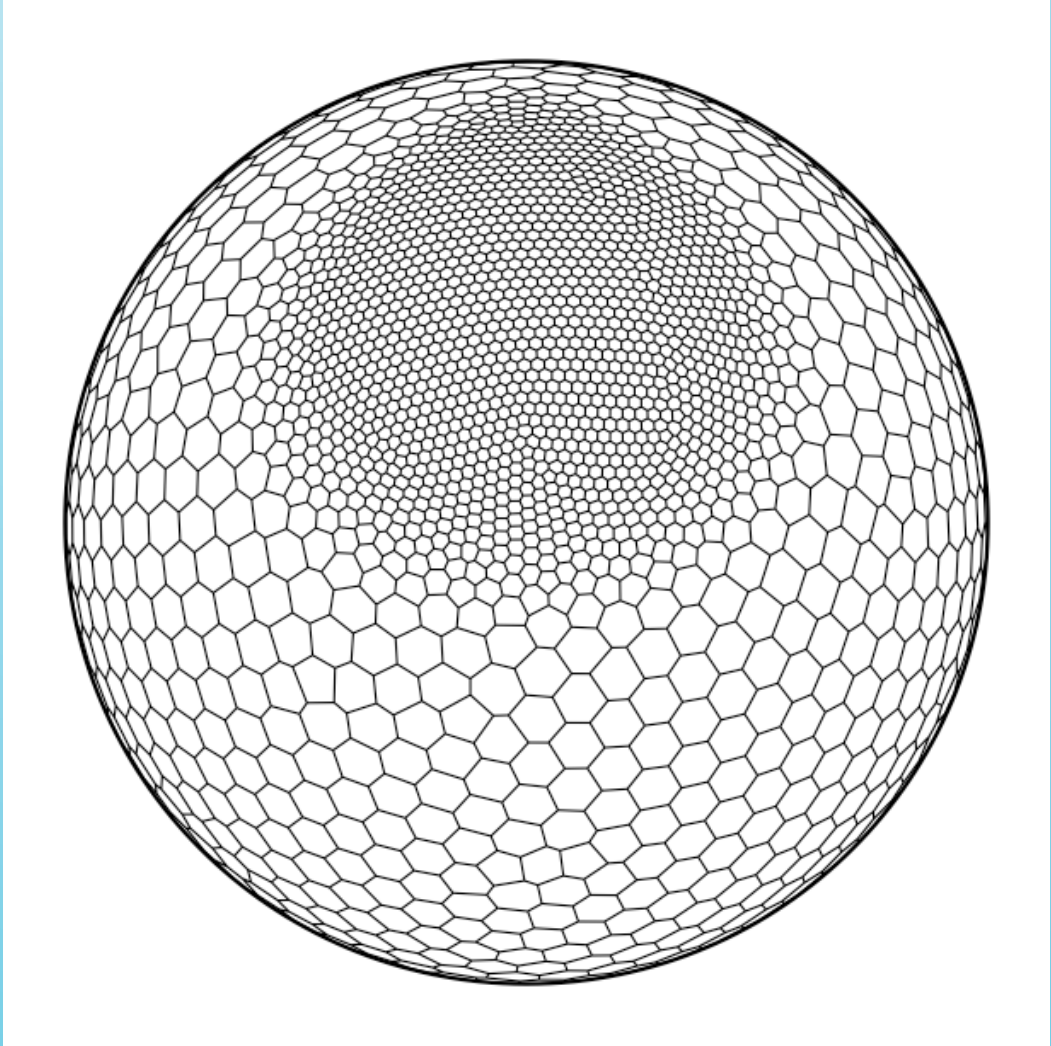
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MPAS

Model for Prediction Across Scales

MPAS: Next Generation Ocean Model



We are developing a next generation ocean model based on the variable-resolution MPAS framework developed jointly by LANL and the National Center for Atmospheric Research. The model will enable us to resolve regional-scale processes in a global model.



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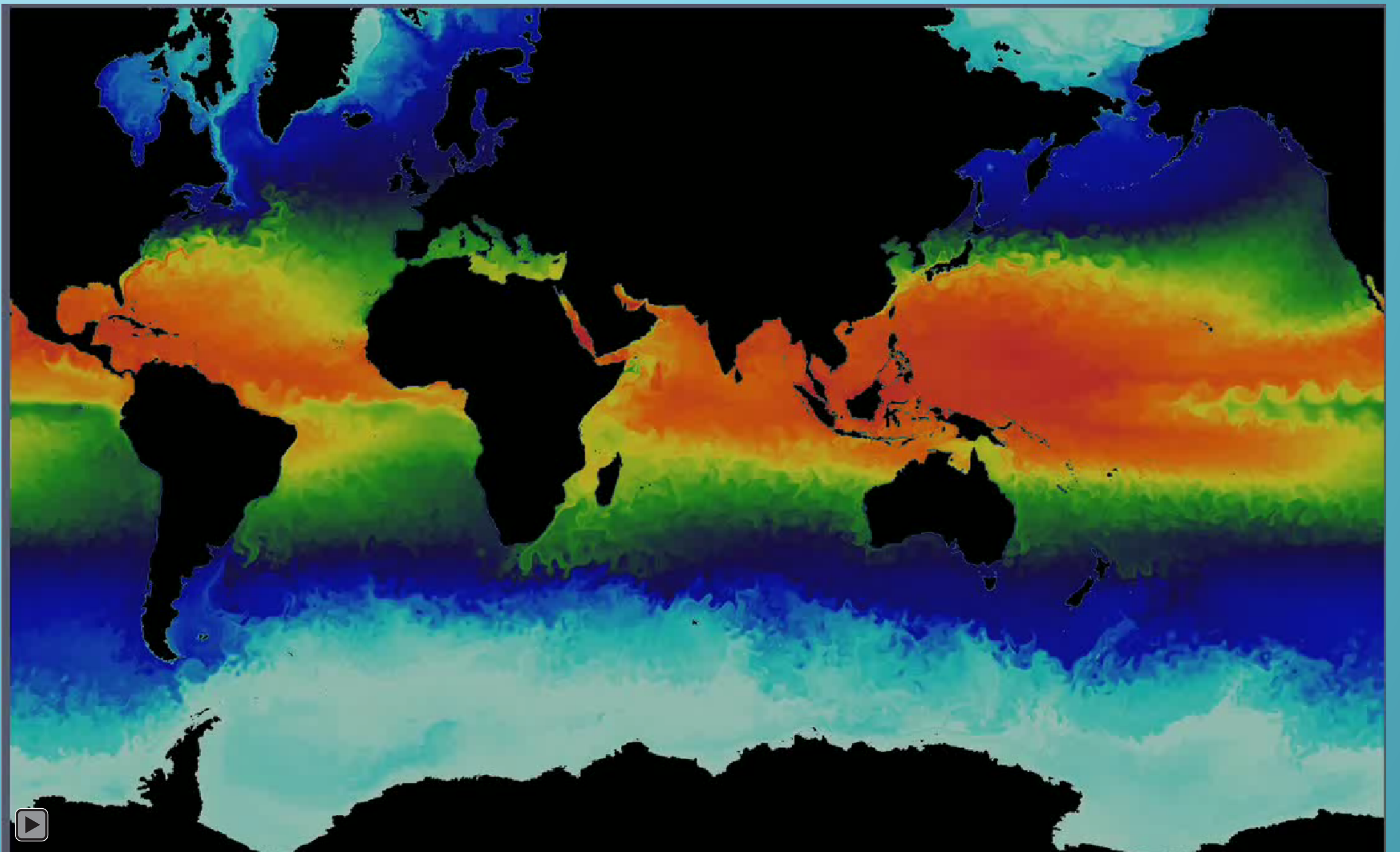
CLIMATE, OCEAN AND SEA ICE MODELING

PARALLEL OCEAN PROGRAM (POP)

Climate Simulation

Parallel Ocean Program (POP) Eddy-resolving Ocean Simulations

High resolution is required to resolve eddies in the ocean with sizes of $\sim 50\text{km}$.



Temperature at 15m depth from a POP eddy-resolving simulation.

Simulations at 10-km resolution result in better representations of the Gulf Stream, North Atlantic circulation, and many other features of ocean circulation.



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